FLOOD PLAIN INFORMATION STUDY

SALINAS NATIONAL MONUMENT

Part 1 of 2

ABO UNIT

Vicinity of Scholle, New Mexico

Ref. MT 7072-2-0060 NPS

Prepared for

U.S. Department of the Interior

National Park Service

by

Department of the Army

Albuquerque District Corps of Engineers

Albuquerque, New Mexico

Introduction

This flood study was prepared by the Albuquerque District U. S. Army Corps of Engineers (COE) for the U. S. Department of the Interior National Park Service (NPS) Southwest Regional Office. The study was authorized in a letter by Mr. Jack Nechels of the NPS dated August 12, 1982. The hydrologic and hydraulic computations were performed by Thomas Ryan, Hydraulic Engineer, of the Hydrologic Engineering Section, Planning Branch, Engineering and Planning Division, COE.

The study addresses the requirements set forth by Executive Order 11988. Briefly, Section 2(a)(1) of E.O. 11988 (May 24, 1977) requires that, "Before taking an action (". . . Federally undertaken, financed or assisted construction and improvements," Section 1), each [federal] agency shall determine whether the proposed action will occur in a floodplain . . ." The term floodplain is defined "as a minimum, areas subject to inundation by a flood with a one percent chance of occuring in any year (i.e., "100-year or base flood")."

The Salinas National Monument, located in Torrance and Socorro Counties of New Mexico, contains three separate units Abo, Quarai and Gran Quivira. This report is Part 1 of a two-part report and covers only the Abo Unit in Torrance County near Scholle, New Mexico. Part 2 of this report will be on the Quarai Unit in Torrance County near Punta de Agua, New Mexico. The Gran Quivira Unit in Socorro County near Gran Quivira, New Mexico, was not requested under this contract and will not be presented.

Mr. Nechels´ previously mentioned letter requested the "2-, 5-, 10-, 50-, 100-, 500- year frequency and Q maximum flood events for both the Abo and Quarai Units" (Salinas National Monument). No need was seen to evaluate the Gran Quivira Unit at present. ´Q maximum´ was interpreted to mean probable maximum flood (PMF) peak. PMF is defined as the runoff from the theoretically greatest depth of precipitation for a given duration that is physically possible over a given size storm area at particular geographical location at a certain time of the year. It was agreed upon verbally between Mr. Garland (Gary) Moore, NPS, and Mr. Thomas Ryan, COE, that only the peak discharge for each event would be calculated and presented.

Mapping for this study and report was provided by the NPS to the COE. The work maps are at a scale of 1 in. = 50 ft. with a contour interval of 1 ft. and are based on aerial photography exposed on September 29, 1978. The mapping was produced under a NPS contract to the Remote Sensing Division of the NPS located at the Bandelier West Building on the University of New Mexico Campus, Albuquerque, New Mexico. The datum is arbitrary and is in no way related to mean sea level. No attempt was made by the COE or the NPS or any other agency to reference the arbitrary datum to a national or state datum. The initial contracting officer for the NPS was Mr. Garland Moore.

Abo Unit, Salinas National Monument

1. Hydrology:

There are no stream gages on any of the flowpaths in the study area. Runoff patterns in the area by observation are due to thunderstorms of varying intensities with the streambeds remaining dry a large portion of the time. No significant detention or diversion structures were found in any portion of the watershed.

Figures 1 through 3 following this text are respectively Regional, Location and Site maps of the project area. Figure 4 is an area map with the major concentration points where peak flows were calculated. Figure 4 also shows the stream numbering system used in this report. The main arroyo, Cañon Espinoso, is labeled Stream 1000 with its tributaries being designated 2000, 3000 and 5000. Stream 4000 is a tributary to Stream 3000.

Peak discharges for the 2-, 5-, 10-, 50-, 100-, 500 year floods were computed using equations and procedures contained in the U. S. Geological Survey's manual, Techniques for Estimating Flood Discharges for Unregulated Streams in New Mexico, Water Resources Investigations 82-24, published in March 1982. The manual contains equations for estimating flood magnitude at selected reoccurance intervals from 2 to 500 years. For all drainage areas greater than one square mile, the equations used for this study are found on page 9 of the manual. The two variables, drainage area and site altitude, were taken at various concentration points from U.S. Geological Survey (USGS) 7-1/2 minute quandrangle sheets of the area (see figure 4). After the peak flows were calculated, expected probability was added according to the procedure found in Appendix 11 of Guidelines for Determining Flood Flow Frequency, Bulletin #17B, Revised September 1981 with Editorial Corrections March 1982, by Interagency Advisory Committee on Water Data published by U. S. Department of the Interior, USGS, Office of Water Data Coordination. The frequency peak flows for drainage areas less than one square mile were computed by first plotting all peak flows, including representative PMF peaks, on logarithmic paper, plotting drainage area versus discharge per square mile. The PMF peaks were obtained from previous Corps' studies and represent drainage areas between 0.13 and 26 square miles. A best fit curve was drawn. The frequency curves for the drainage areas below one square mile were adjusted to reflect the same curvature as the PMF curve below one square mile. The final series of curves are shown in figure 5. The corresponding peak flows for the 2-, 5-, 10-, 50-, 100-, 500- year floods and PMF are shown in Table 1 as follows:

Table 1

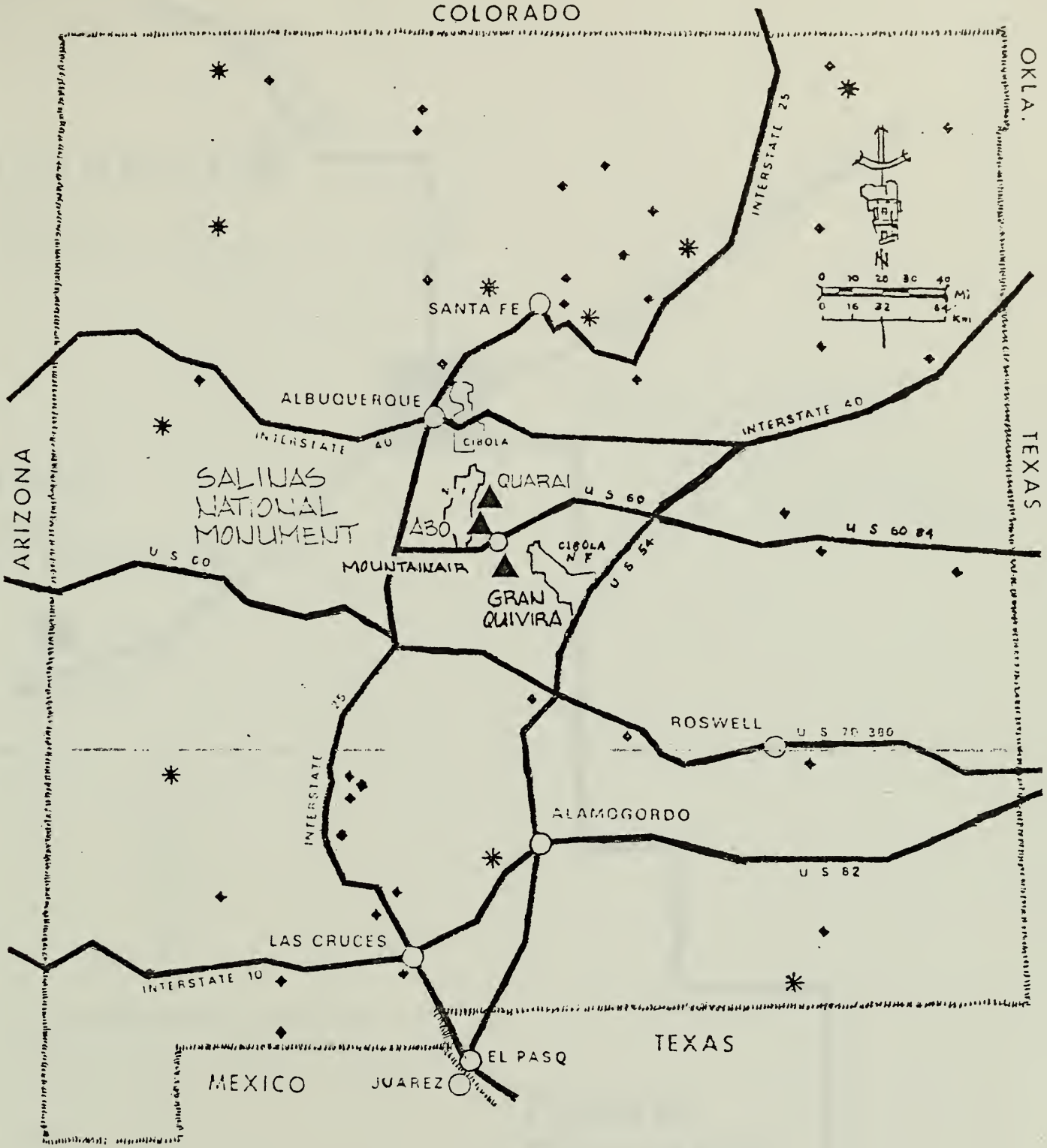
Peak Flows in C.F.S.

Concentration Point Number	Stream	Peak Flows (CFS) Q2	Q5	Q10	Q50	Q100	Q500	QPMF
1	1000	275	680	1130	2800	3950	8100	62100
2	1000	269	670	1115	2710	3850	7800	61600
2a	1000	268	665	1110	2700	3750	7700	61350
2b	2000	14	42	73	201	304	690	2300
3	1000	267	660	1100	2700	3700	7500	61300
3a	1000	235	600	990	2500	3500	7100	53350
3b	3000	122	330	560	1500	2100	4450	24500
4	1000	231	595	970	2400	3330	6750	53100
4a	5000	14	40	70	193	290	662	2200
4b	1000	229	590	955	2310	3300	6700	53000
5	1000	229	570	950	2300	3280	6690	52950
6	5000	12	37	64	174	264	600	2000
7	3000	120	325	555	1450	2100	4400	24400
7a	3000	118	320	540	1430	2050	4300	23900
7b	4000	12	37	64	174	264	600	2000
8	2000	5	14	25	68	103	217	750
9	4000	10	31	54	147	224	507	1700
10	3000	115	310	515	1370	1970	4200	23800

2. Hydraulics

Water surface elevations were calculated using the COE's HEC-2 computer program. Cross sections were taken from the work maps provided by the NPS. Channel and overbank roughness values were based on field observations and expressed as Manning's 'n' values. Calculations were made in a backwater mode. Where the streambed exceeded critical slope the minimum calculated water surface elevation used was critical depth. Experience, observations and engineering judgment have shown that a natural channel can rarely, if ever, sustain supercritical flow over an appreciable distance and/or time period in the non-turbulent flow range. Critical depth is used to provide a safety factor for the obviously turbulent, unstable flow. In reaches where the streambed has a less than critical slope the water surface depth will be greater than critical depth. Flood depths may be determined at a particular point from the flood profiles on plates 1 through 14. The streambed profile shown on those plates are based on the lowest point in the streambed along each cross section. The actual ground may vary from the profile for a number of reasons. These include, but are not limited to, errors in mapping, changes in the streambed since mapping was accomplished, "straightlining" the profile between cross sections and the estimations of lowest point elevation taken from the mapping. However, these errors should not appreciably affect the flood depths at any particular point along the streams. The arroyo beds are being eroded at varying rates. Occasionally, the channel walls fracture with some large rock mass falling into the flow path. These channel features make the flood depths and flood plains susceptible to sudden change. However, except in extremely rare circumstances, the changes are not anticipated to be significant.

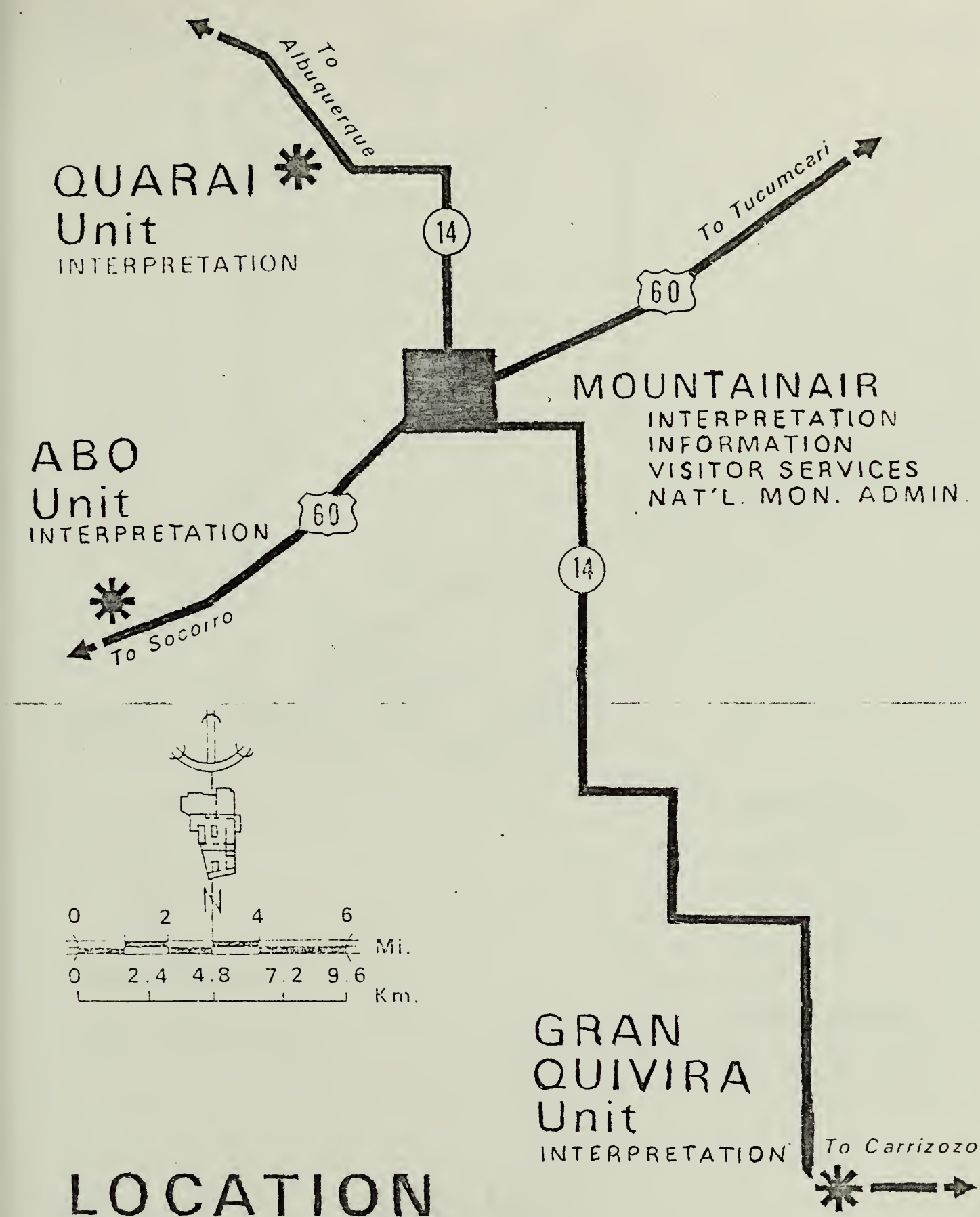
Figure 6 is the 100-year frequency floodplain map of the Abo Unit which shows the study limits. The PMF peaks were calculated for all flow paths but the PMF backwater run for Cañon Espinoso resulted in a basin overflow at the upper portion of the study. The NPS representative agreed to forego the requested PMF backwater calculation for simplification and cost savings in trying to figure the flow split and subsequent reduction in peak discharge on stream 1000 and the impact, if any, on the PMF peak flow on stream 3000.



THE REGION

Salinas National Monument New Mexico
United States Department of the Interior / NPS

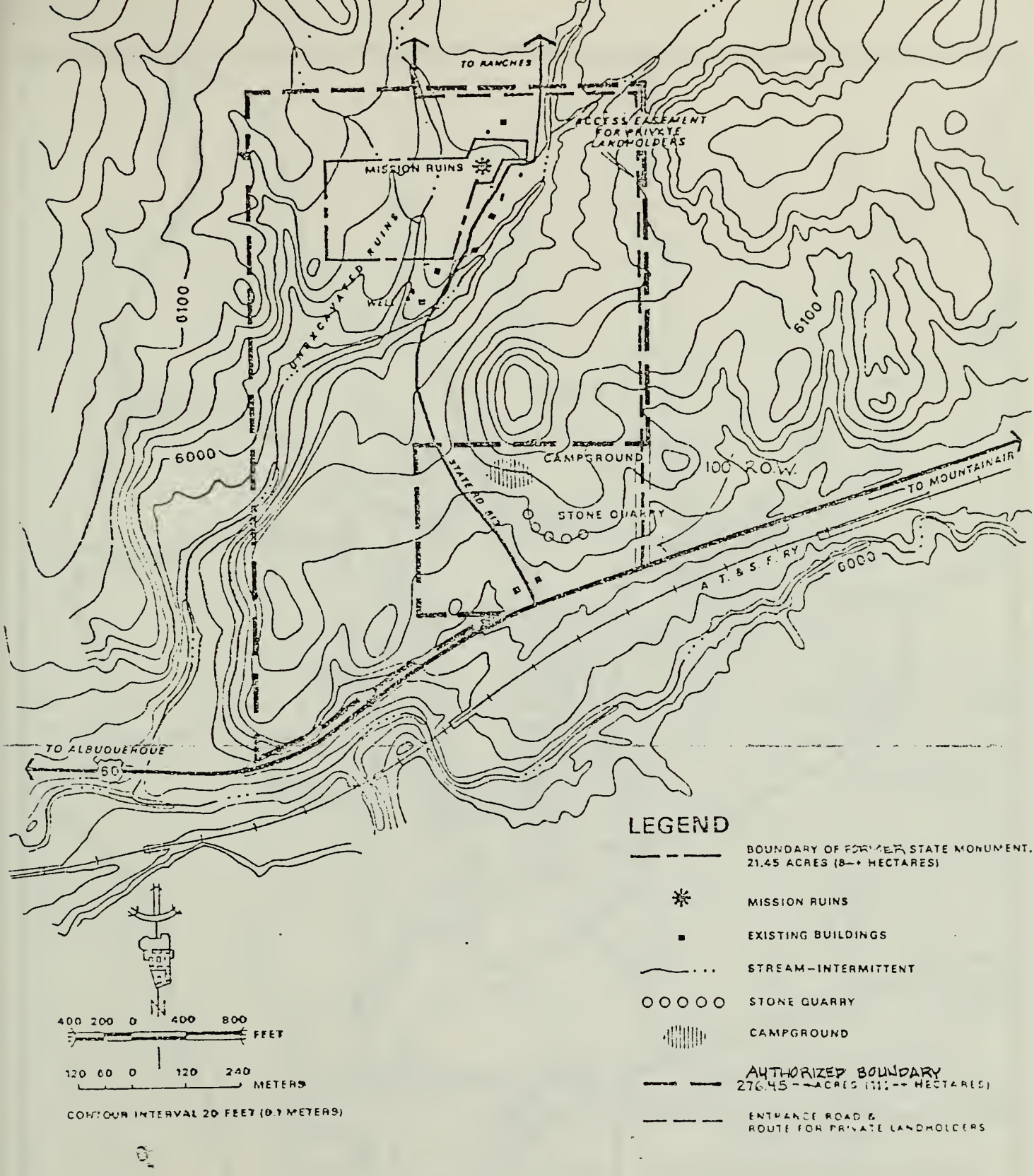
FIGURE 1



LOCATION

Salinas National Monument, New Mexico
United States Department of the Interior/NPS

FIGURE 2



ABO UNIT

Salinas National Monument, New Mexico
United States Department of the Interior/NPS

FIGURE 3

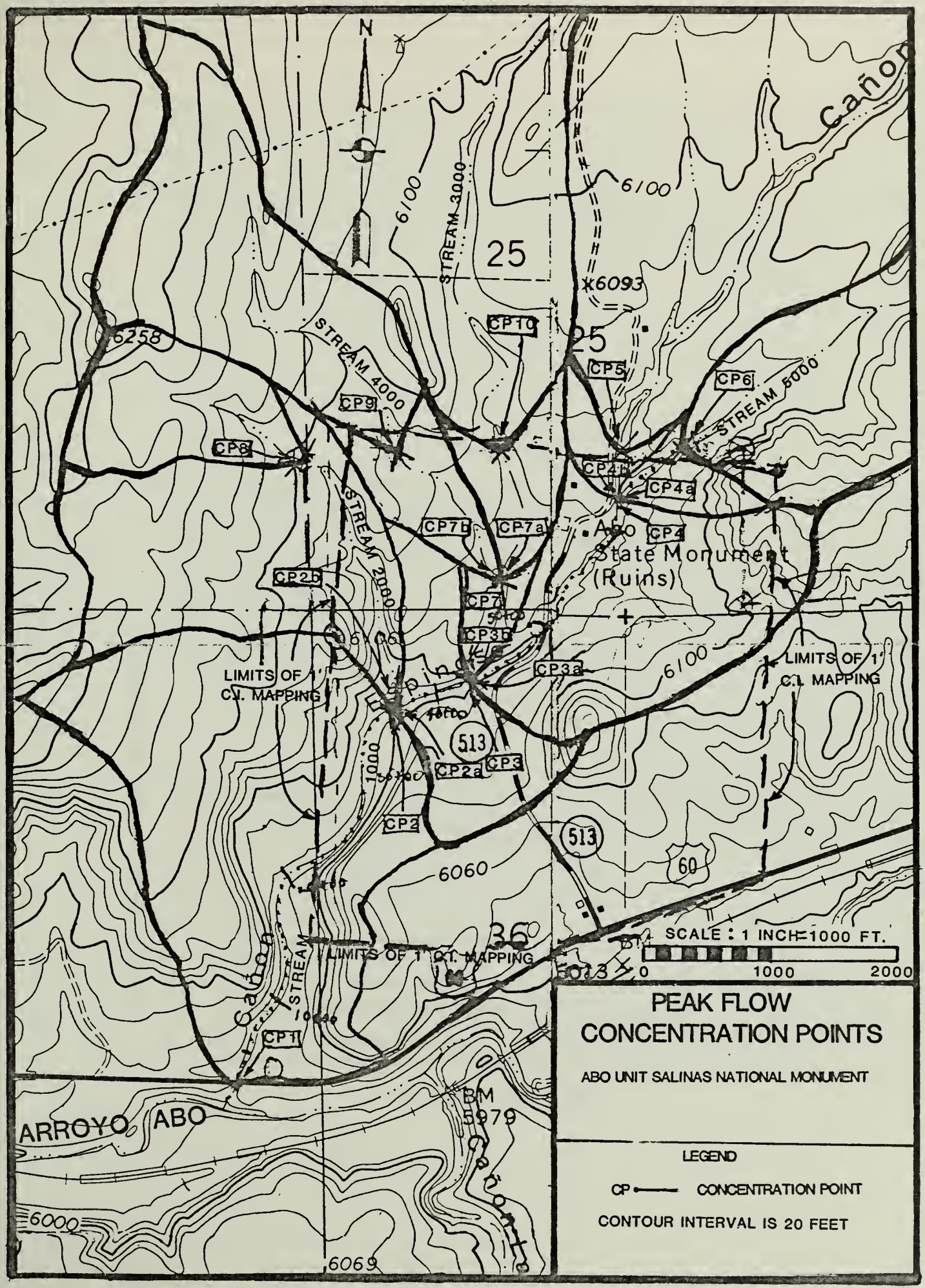

N
25
6100
STREAM 3000
6093
Cañon
6258
CP10
CP5
CP6
STREAM 5000
CP9
STREAM 4000
CP8
CP4b
CP4a
CP7b
CP7a
Abo
CP4
State Monument
(Ruins)
CP2b
STREAM 2000
CP7
CP3b
CP3a
LIMITS OF 1' C.I. MAPPING
LIMITS OF 1' C.I. MAPPING
513
CP2a
CP3
1000
CP2
6060
60
36
SCALE : 1 INCH=1000 FT.
0
1000
2000
LIMITS OF 1' C.I. MAPPING
5013
Cañon
STREAM
CP1
ARROYO ABO
BM
5979
6000
6069
PEAK FLOW
CONCENTRATION POINTS
ABO UNIT SALINAS NATIONAL MONUMENT
LEGEND
CP — CONCENTRATION POINT
CONTOUR INTERVAL IS 20 FEET

FIGURE 4

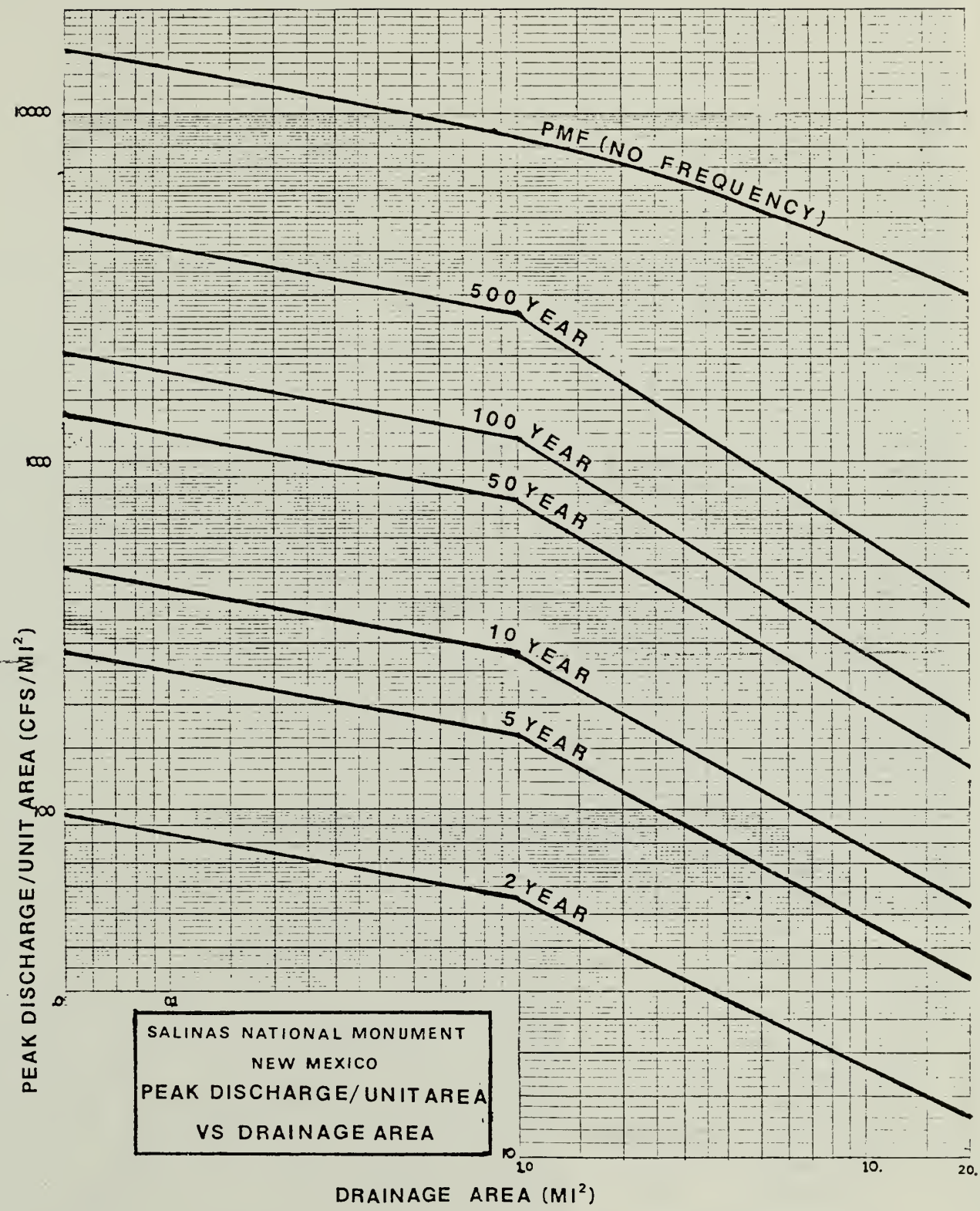

PMF (NO FREQUENCY)
500 YEAR
100 YEAR
50 YEAR
10 YEAR
5 YEAR
2 YEAR
PEAK DISCHARGE/UNIT AREA (CFS/MI²)
DRAINAGE AREA (MI²)
10.
20.
SALINAS NATIONAL MONUMENT
NEW MEXICO
PEAK DISCHARGE/UNIT AREA
VS DRAINAGE AREA

FIGURE 5

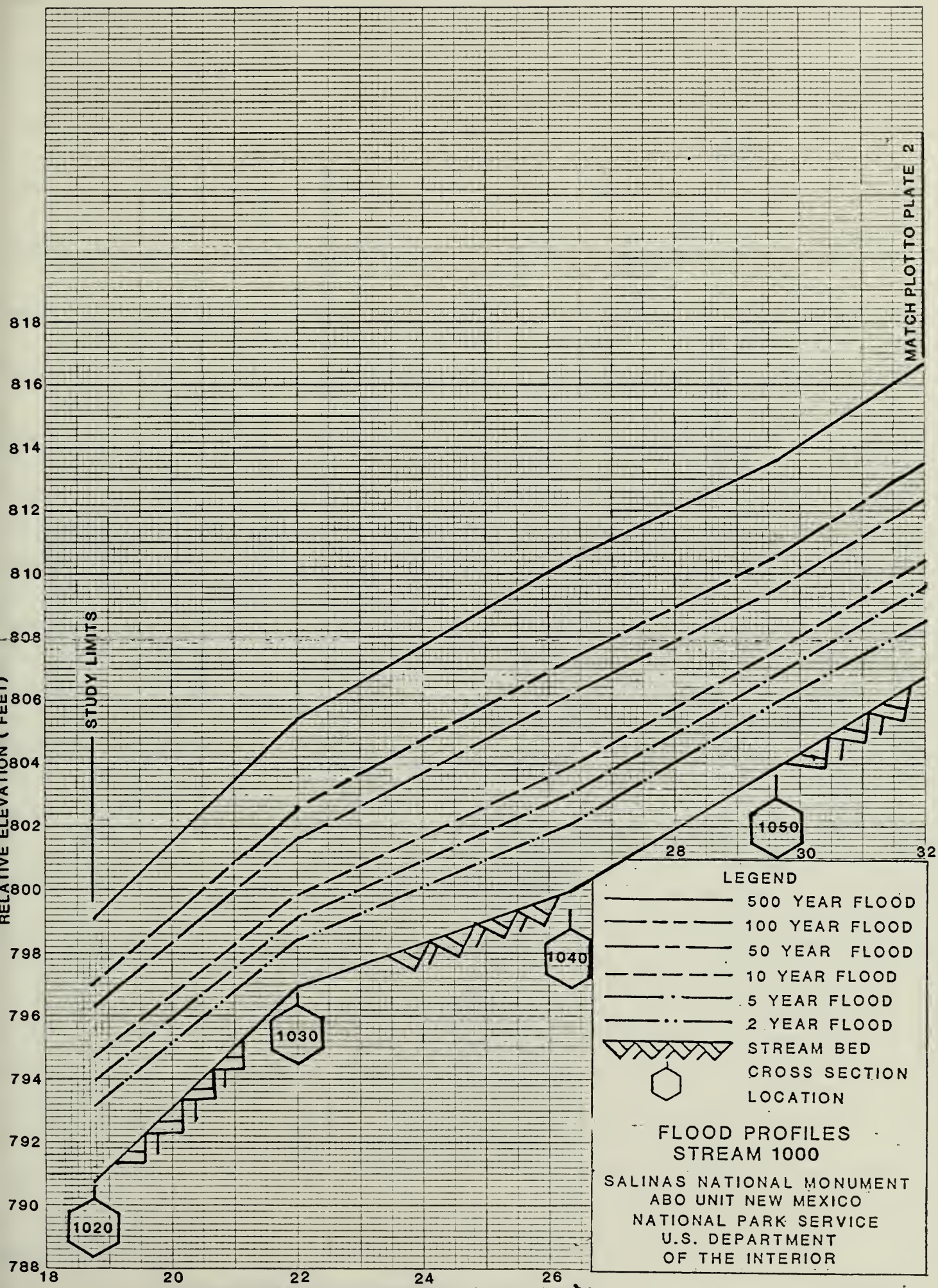
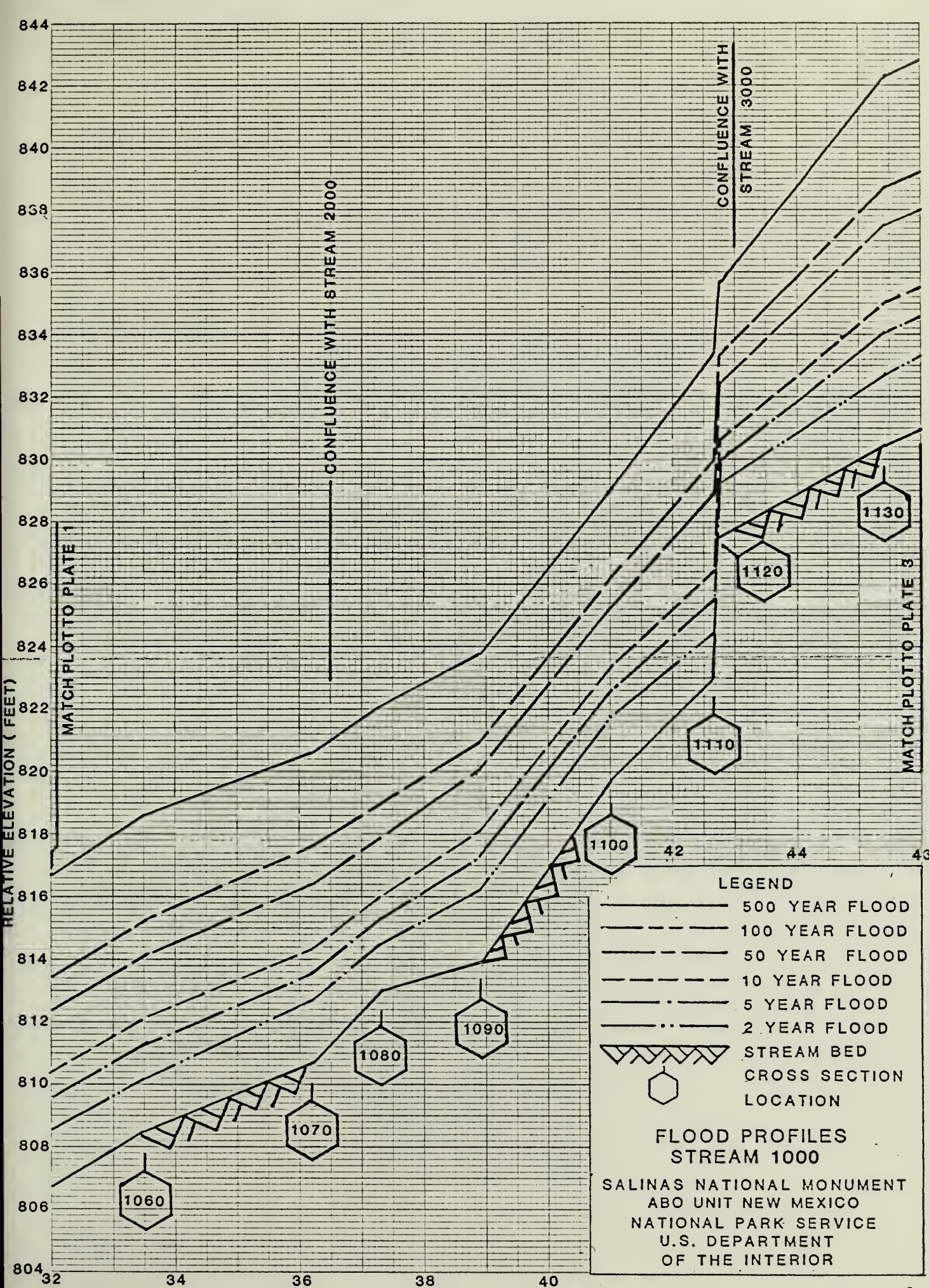

MATCH PLOT TO PLATE 2
STUDY LIMITS
RELATIVE ELEVATION (FEET)
818
816
814
812
810
808
806
804
802
800
798
796
794
792
790
788
18
20
22
24
26
28
30
32
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)
1020
1030
1040
1050
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 1000
SALINAS NATIONAL MONUMENT
ABO UNIT NEW MEXICO
NATIONAL PARK SERVICE
U.S. DEPARTMENT
OF THE INTERIOR

PLATE 1


RELATIVE ELEVATION (FEET)
844
842
840
838
836
834
832
830
828
826
824
822
820
818
816
814
812
810
808
806
804
32
34
36
38
40
STREAM DISTANCE ABOVE MOUTH (FEET X 10²)
CONFLUENCE WITH STREAM 2000
CONFLUENCE WITH STREAM 3000
MATCH PLOT TO PLATE 1
MATCH PLOT TO PLATE 3
1060
1070
1080
1090
1100
1110
1120
1130
42
44
43
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED CROSS SECTION LOCATION
FLOOD PROFILES
STREAM 1000
SALINAS NATIONAL MONUMENT
ABO UNIT NEW MEXICO
NATIONAL PARK SERVICE
U.S. DEPARTMENT
OF THE INTERIOR
PLATE 2

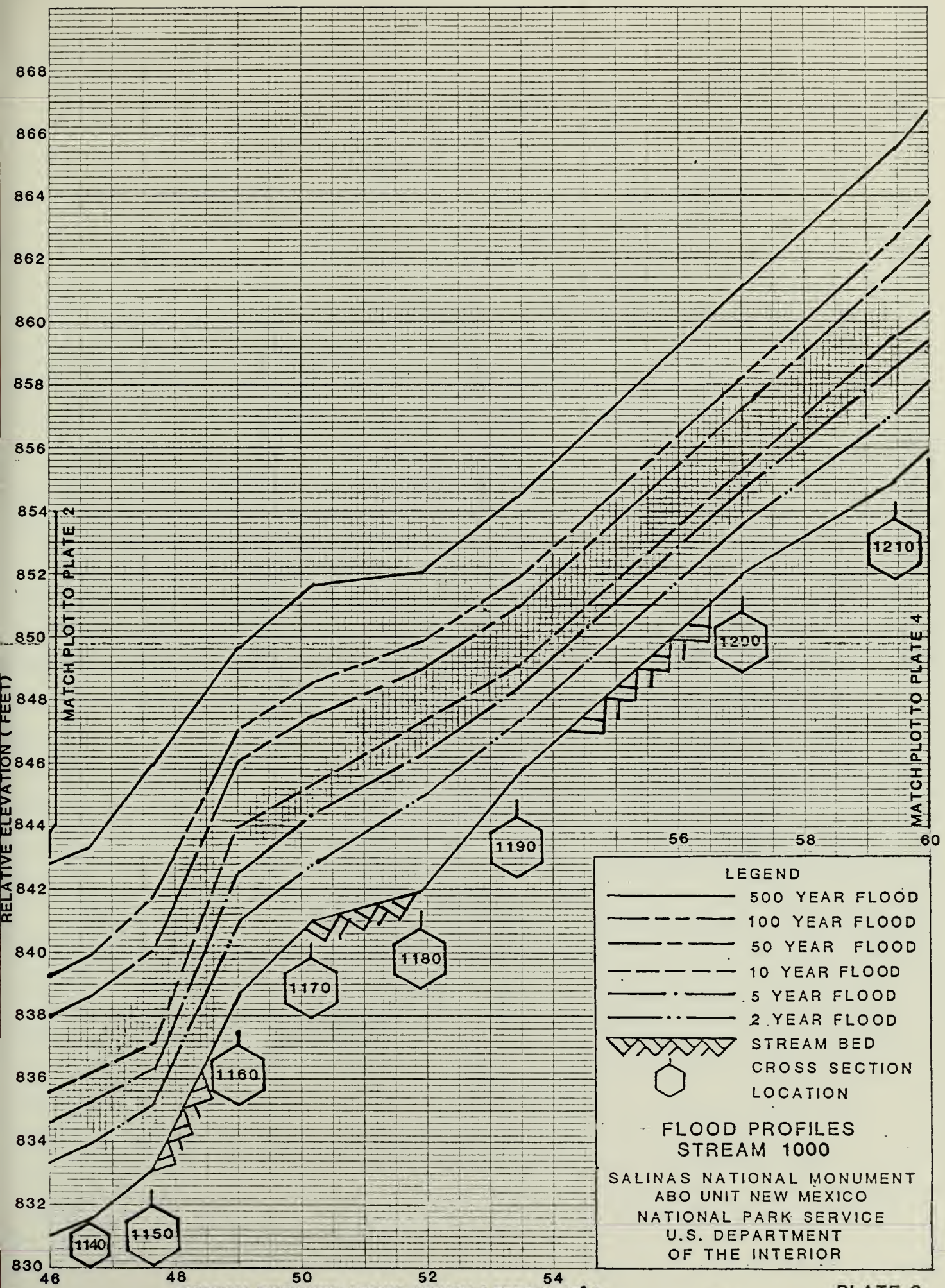

RELATIVE ELEVATION (FEET)
868
866
864
862
860
858
856
854
852
850
848
846
844
842
840
838
836
834
832
830
MATCH PLOT TO PLATE 2
MATCH PLOT TO PLATE 4
46
48
50
52
54
56
58
60
STREAM DISTANCE ABOVE MOUTH (FEET X 10²)
1140
1150
1160
1170
1180
1190
1200
1210
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
STREAM 1000
SALINAS NATIONAL MONUMENT
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PLATE 3

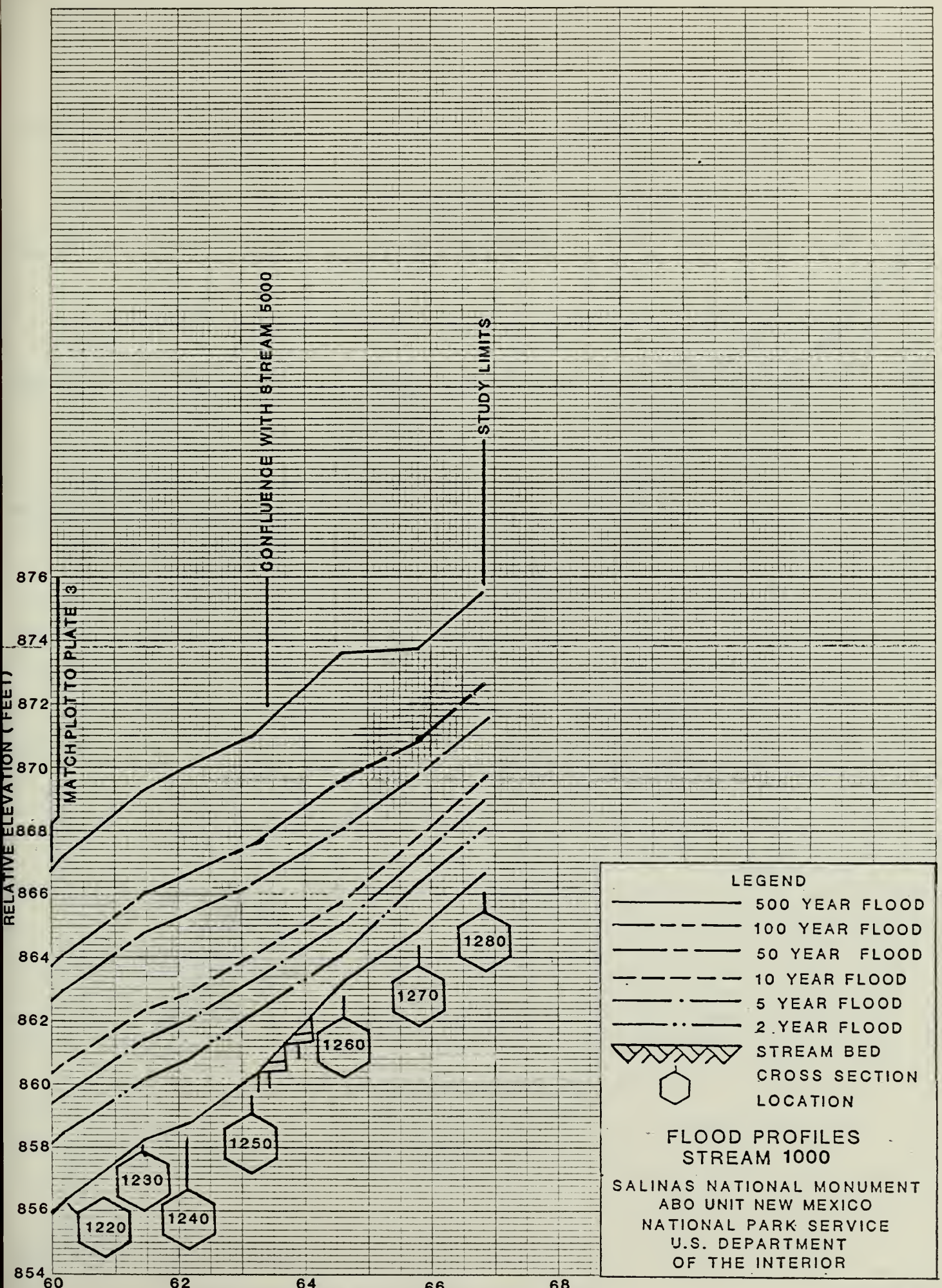
CONFLUENCE WITH STREAM 5000
STUDY LIMITS
MATCH PLOT TO PLATE 3
RELATIVE ELEVATION (FEET)
876
874
872
870
868
866
864
862
860
858
856
854
60
62
64
66
68
STREAM DISTANCE ABOVE MOUTH (FEET X 10^2)
1220
1230
1240
1250
1260
1270
1280
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 1000
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PLATE 4

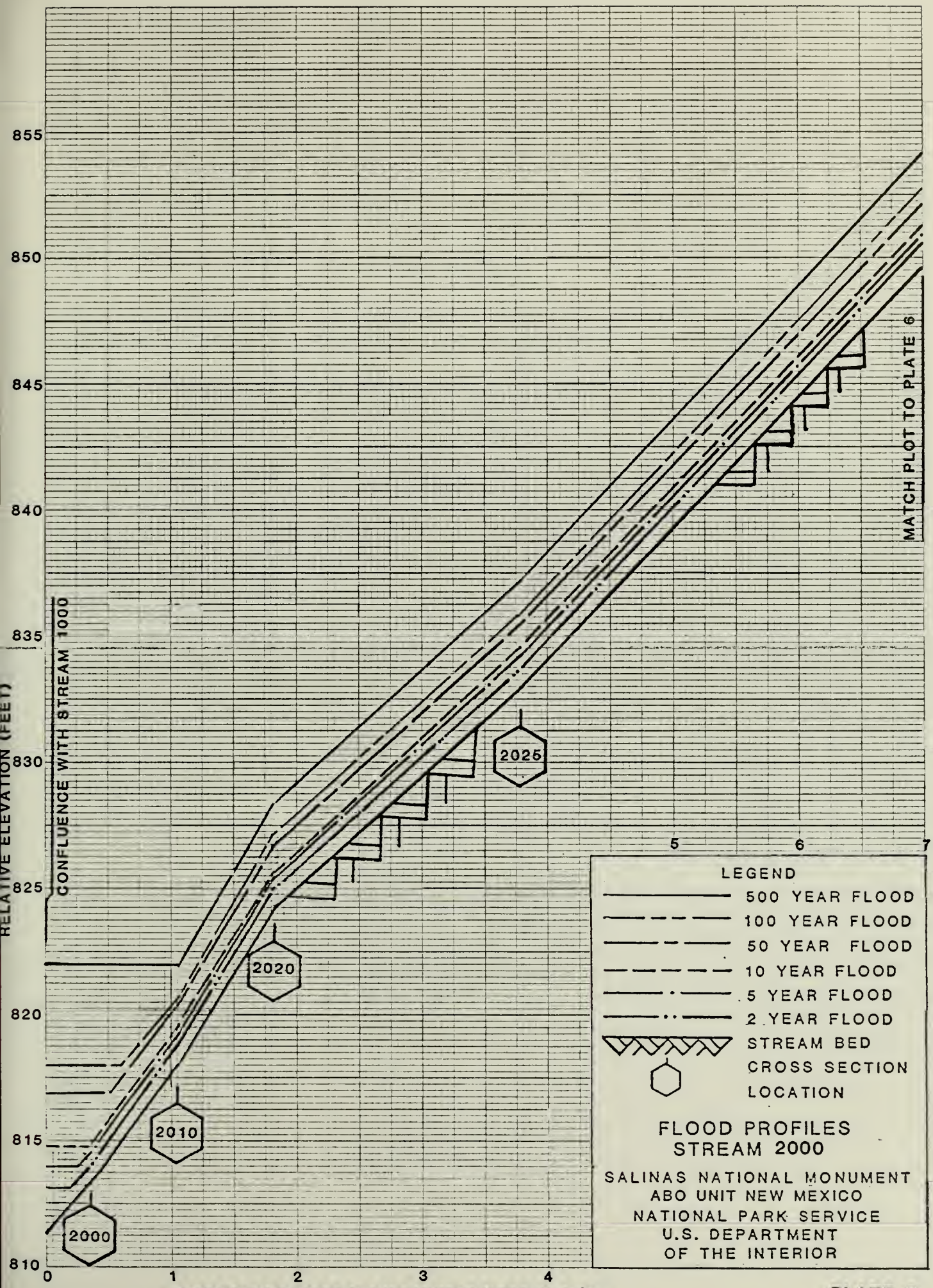
RELATIVE ELEVATION (FEET)
855
850
845
840
835
830
825
820
815
810
CONFLUENCE WITH STREAM 1000
MATCH PLOT TO PLATE 6
2000
2010
2020
2025
0
1
2
3
4
5
6
7
STREAM DISTANCE ABOVE MOUTH (FEET X 10²)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 2000
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PLATE 5

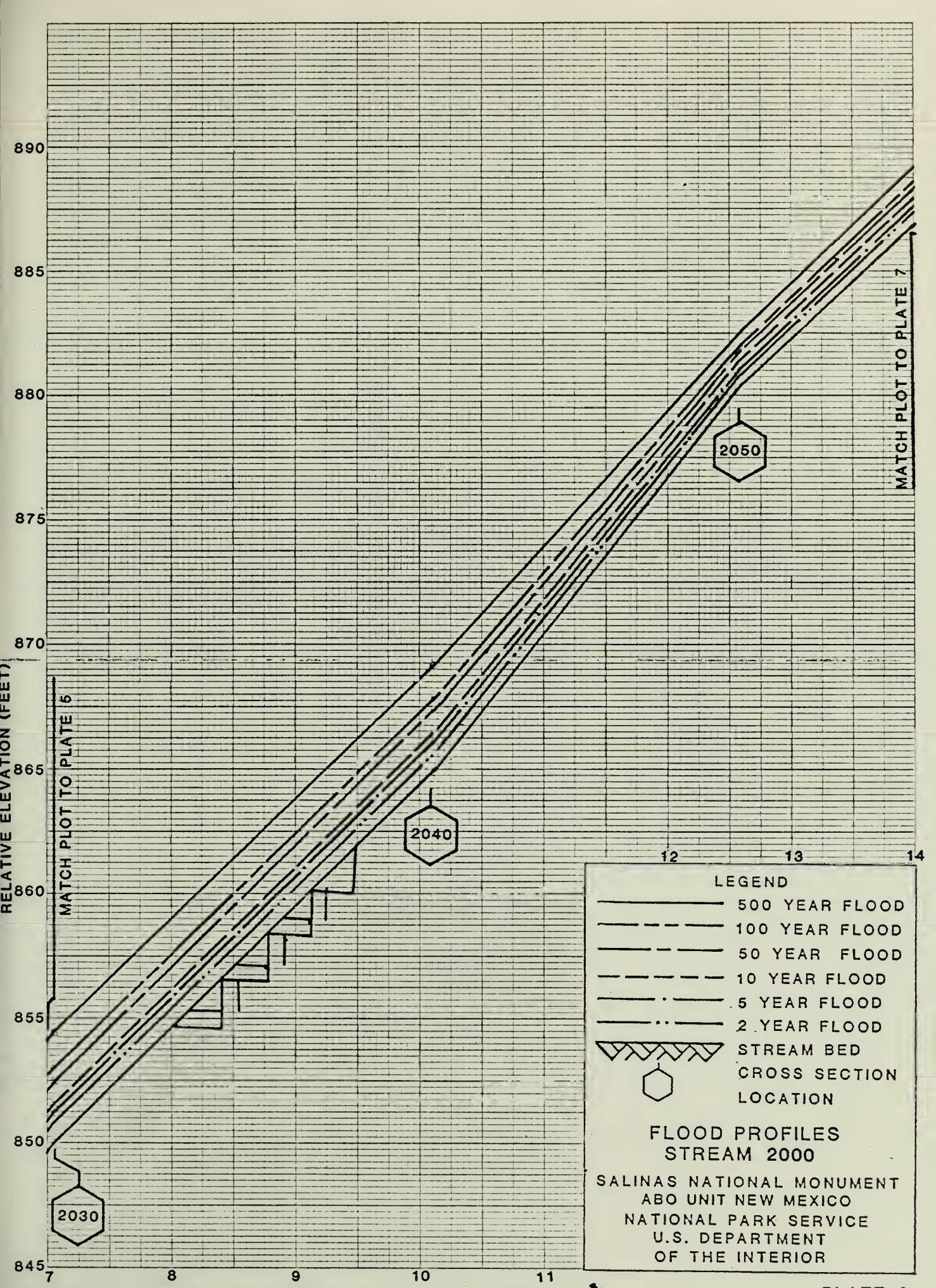
RELATIVE ELEVATION (FEET)
890
885
880
875
870
865
860
855
850
845
MATCH PLOT TO PLATE 6
MATCH PLOT TO PLATE 7
2030
2040
2050
7
8
9
10
11
12
13
14
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
STREAM 2000
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PLATE 6

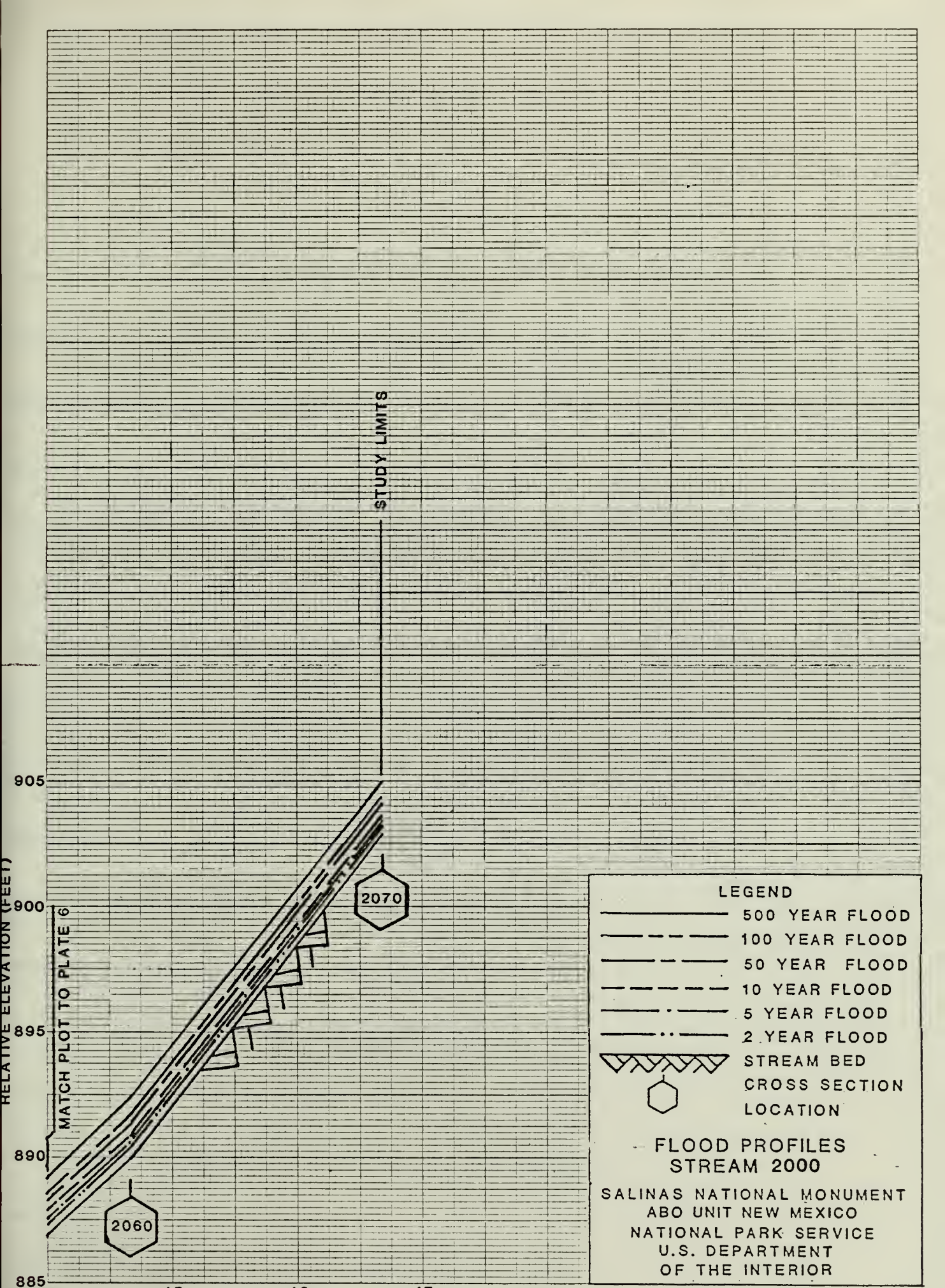
STUDY LIMITS
2070
2060
MATCH PLOT TO PLATE 6
RELATIVE ELEVATION (FEET)
905
900
895
890
885
14
15
16
17
STREAM DISTANCE ABOVE MOUTH (FEET X 10⁴)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 2000
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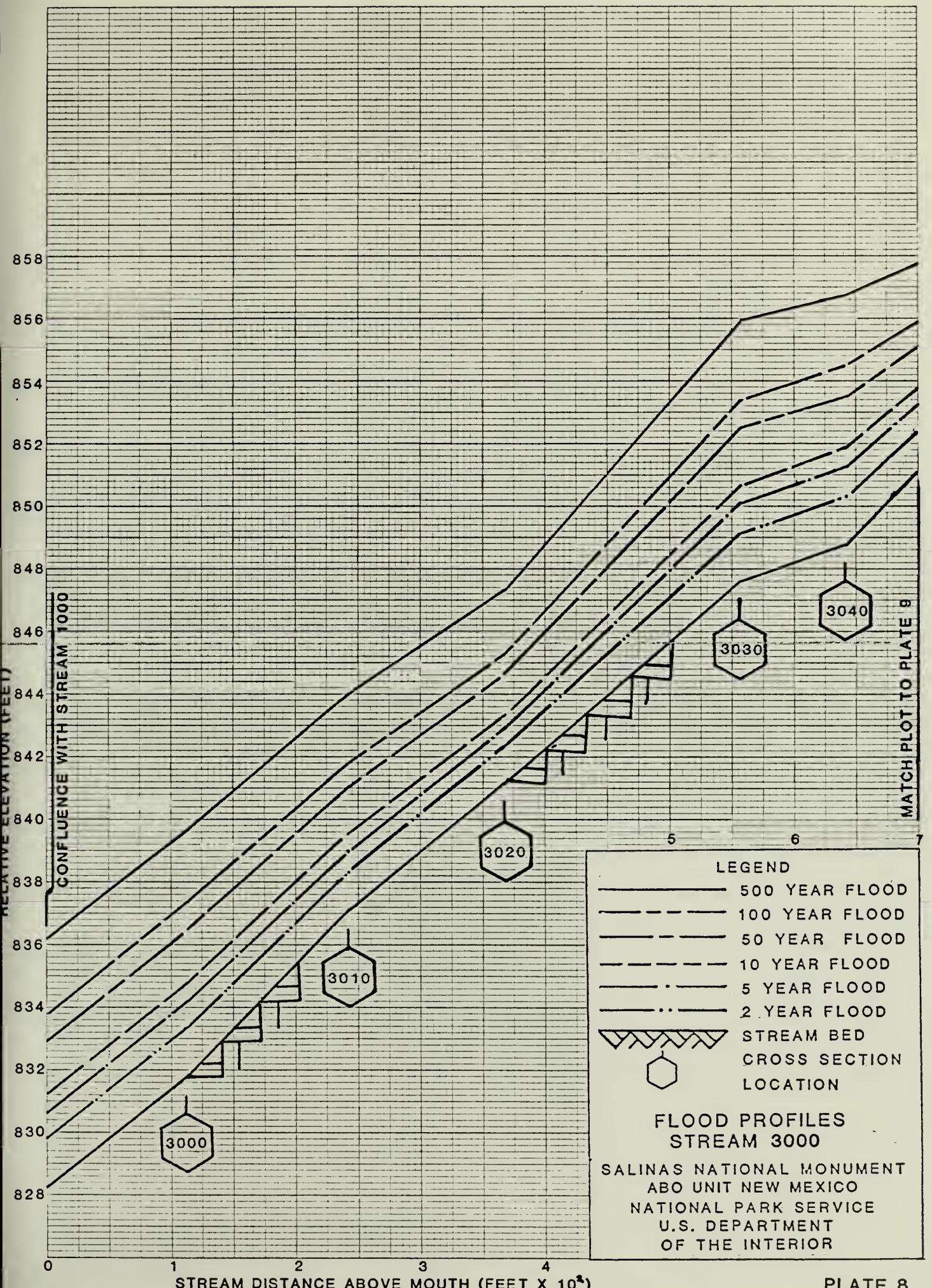
PLATE 7


858
856
854
852
850
848
846
844
842
840
838
836
834
832
830
828
RELATIVE ELEVATION (FEET)
CONFLUENCE WITH STREAM 1000
MATCH PLOT TO PLATE 9
5
6
7
3040
3030
3020
3010
3000
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 3000
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0
1
2
3
4
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)

PLATE 8

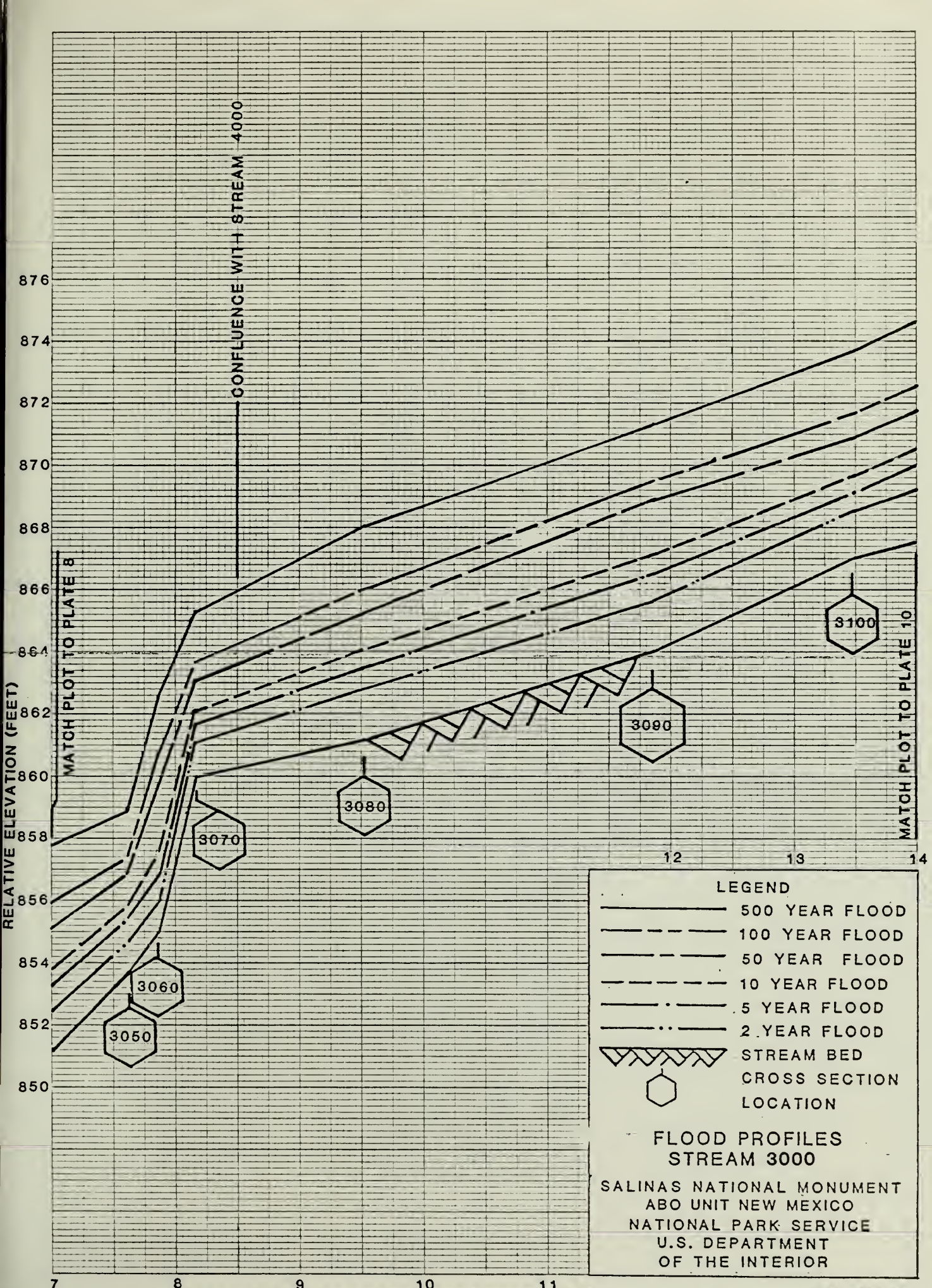
CONFLUENCE WITH STREAM 4000
MATCH PLOT TO PLATE 8
MATCH PLOT TO PLATE 10
RELATIVE ELEVATION (FEET)
876
874
872
870
868
866
864
862
860
858
856
854
852
850
3100
3090
3080
3070
3060
3050
12
13
14
7
8
9
10
11
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
STREAM 3000
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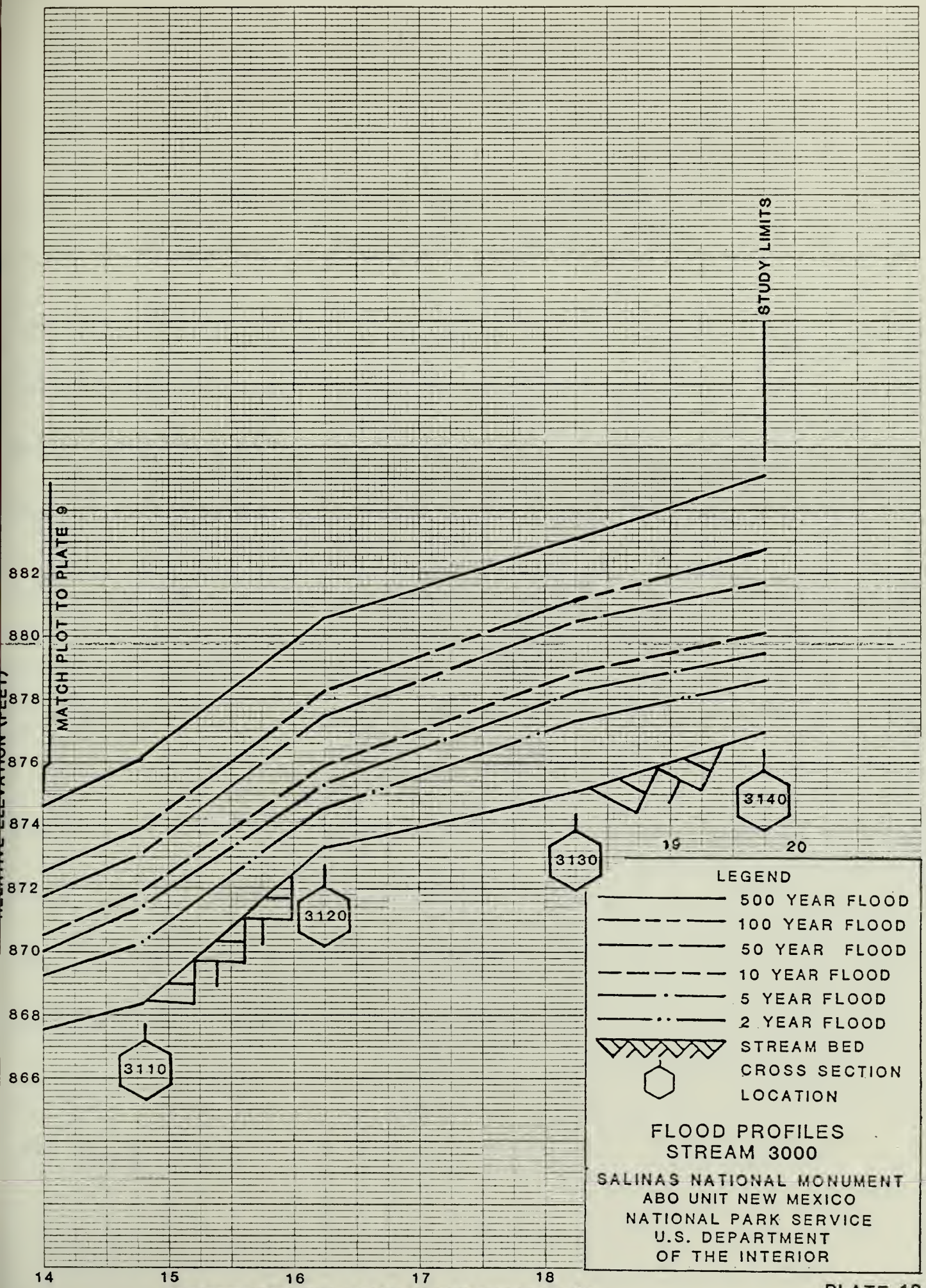
PLATE 9


STUDY LIMITS
MATCH PLOT TO PLATE 9
882
880
878
876
874
872
870
868
866
3110
3120
3130
3140
19
20
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 3000
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14
15
16
17
18
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)

PLATE 10

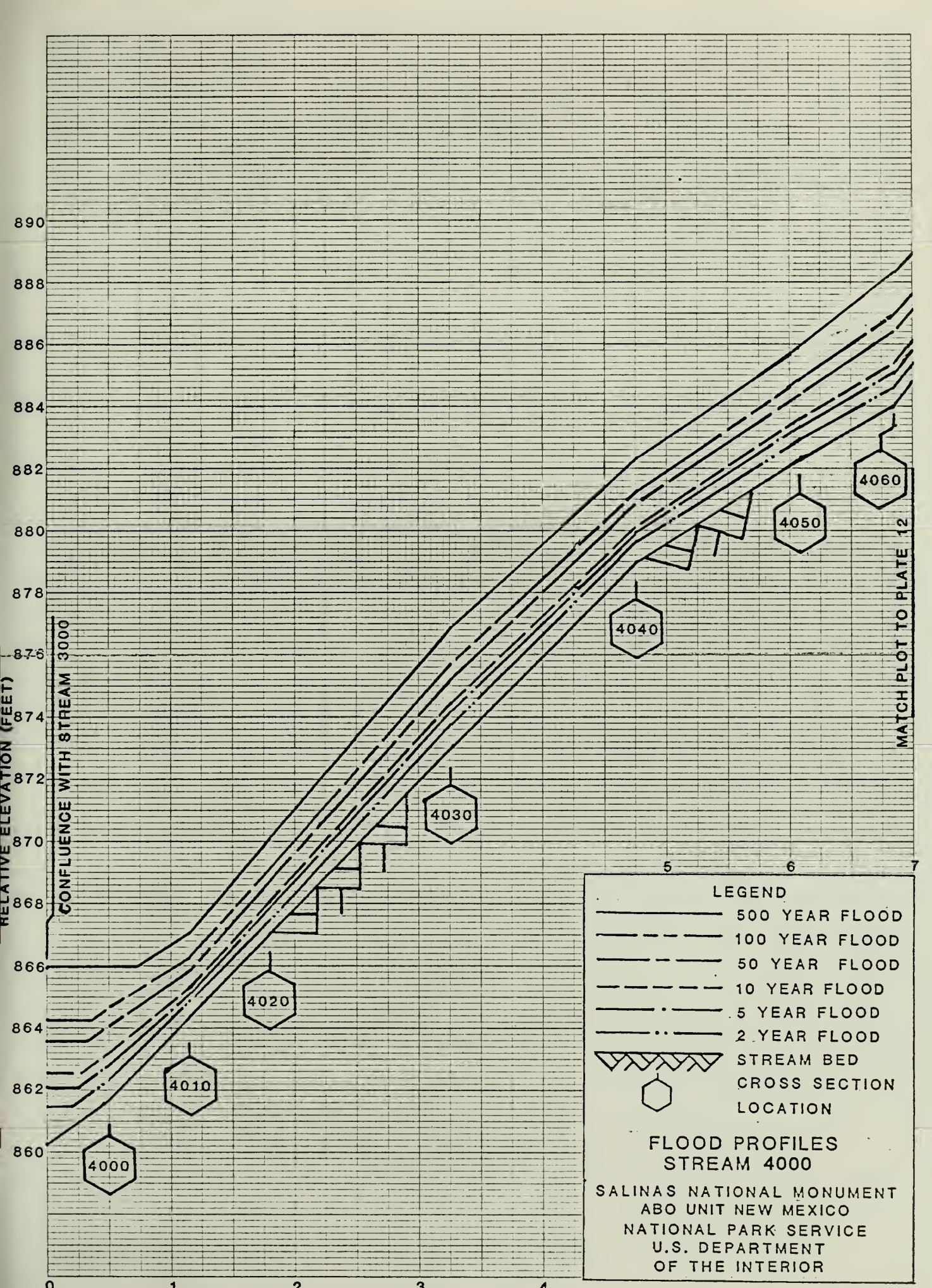
RELATIVE ELEVATION (FEET)
890
888
886
884
882
880
878
876
874
872
870
868
866
864
862
860
CONFLUENCE WITH STREAM 3000
MATCH PLOT TO PLATE 12
4000
4010
4020
4030
4040
4050
4060
0
1
2
3
4
5
6
7
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 4000
SALINAS NATIONAL MONUMENT
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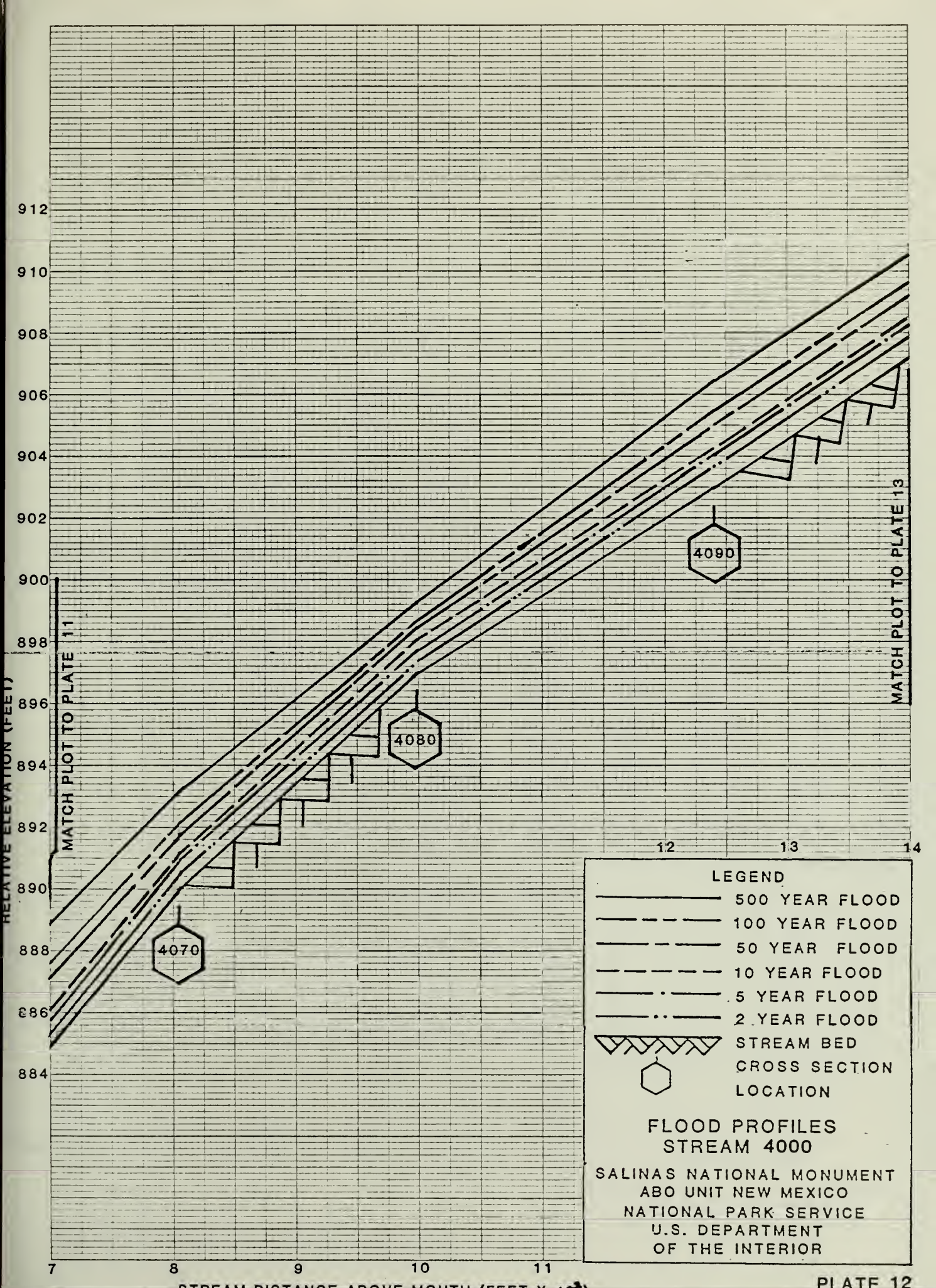
PLATE 11


912
910
908
906
904
902
900
898
896
894
892
890
888
886
884
RELATIVE ELEVATION (FEET)
MATCH PLOT TO PLATE 11
MATCH PLOT TO PLATE 13
4070
4080
4090
7
8
9
10
11
12
13
14
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION LOCATION
FLOOD PROFILES
STREAM 4000
SALINAS NATIONAL MONUMENT
ABO UNIT NEW MEXICO
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OF THE INTERIOR
PLATE 12

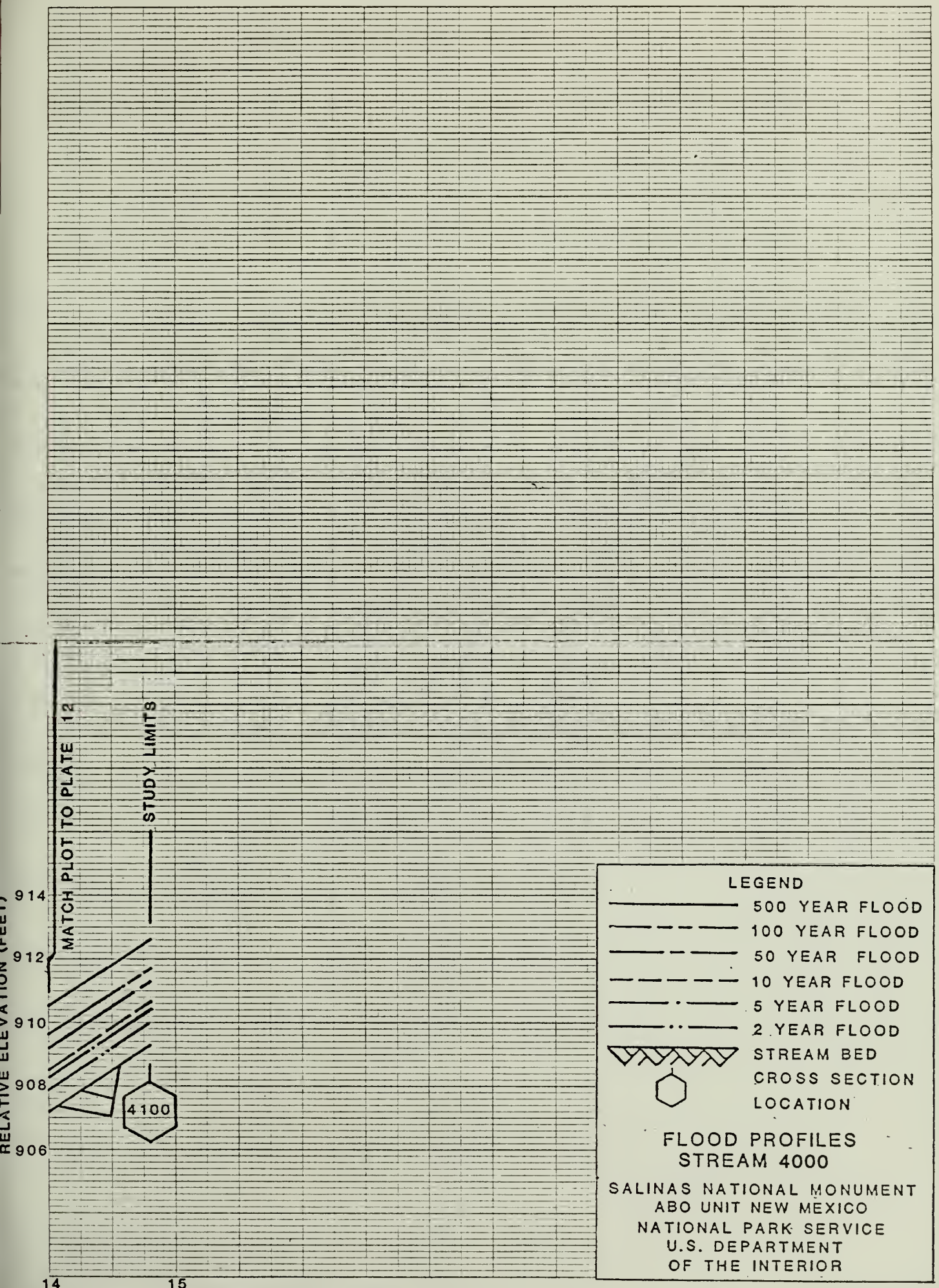
MATCH PLOT TO PLATE 12
STUDY LIMITS
914
912
910
908
906
RELATIVE ELEVATION (FEET)
4100
14
15
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 4000
SALINAS NATIONAL MONUMENT
ABO UNIT NEW MEXICO
NATIONAL PARK SERVICE
U.S. DEPARTMENT
OF THE INTERIOR

PLATE 13

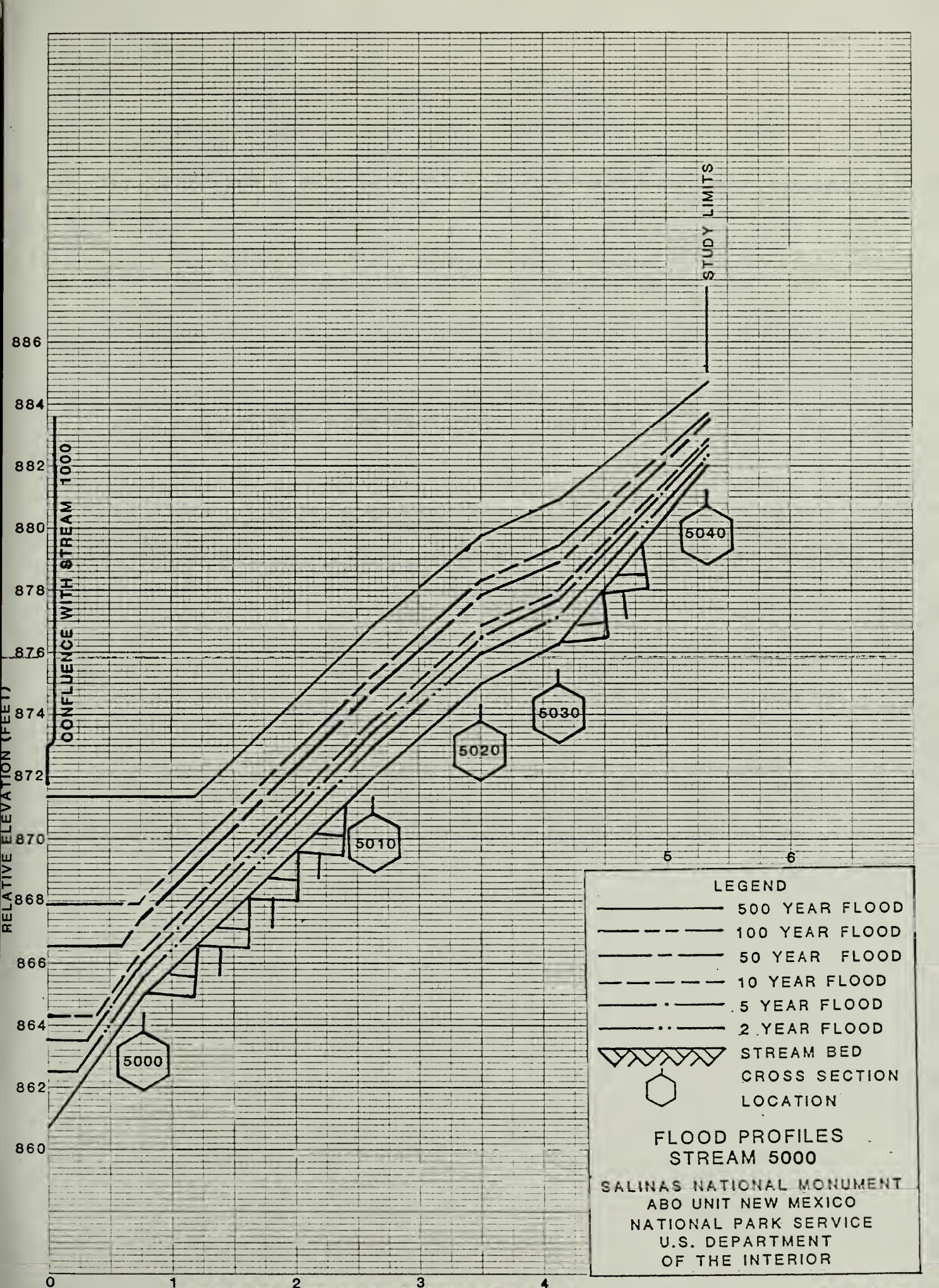
STUDY LIMITS
CONFLUENCE WITH STREAM 1000
RELATIVE ELEVATION (FEET)
886
884
882
880
878
876
874
872
870
868
866
864
862
860
5000
5010
5020
5030
5040
5
6
0
1
2
3
4
STREAM DISTANCE ABOVE MOUTH (FEET X 10³)
LEGEND
500 YEAR FLOOD
100 YEAR FLOOD
50 YEAR FLOOD
10 YEAR FLOOD
5 YEAR FLOOD
2 YEAR FLOOD
STREAM BED
CROSS SECTION
LOCATION
FLOOD PROFILES
STREAM 5000
SALINAS NATIONAL MONUMENT
ABO UNIT NEW MEXICO
NATIONAL PARK SERVICE
U.S. DEPARTMENT
OF THE INTERIOR

PLATE 14

FIGURE 6